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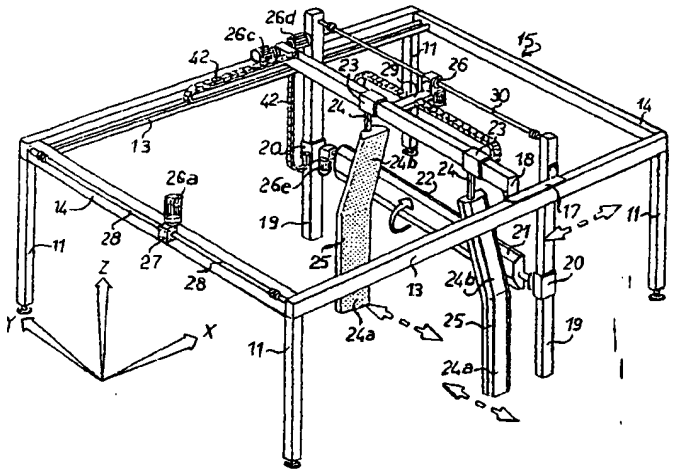
(54) Title: A PLANT FOR DRYING PAINTED SURFACES WITH PARTICULAR REFERENCE TO VEHICLES AND THEIR STRIPPED OWN PARTS AND THE VARIOUS CONTROL PROCEDURES USED



(57) Abstract: A drying plant for vanished surfaces, in particular vehicules and their stripped down parts, that includes a main framework, a first part (18) movable in a first direction (X) and at least a second part (21) which is connected to the first part (18), movable in at lest one second direction (Z) and rotatable around an axis parallel to one third direction (Y). Panels (22, 25), selectively pre-heated, are connected to the first and second parts (18, 21). Tracking control means selectively command the motion of the movable parts (18, 21) along the first and the second direction (X, Z), respectively, depending on pre-determined operative parameters. Sensors (39, 40) can be associated to the movable part (21) to determine the relative orientation with reference to the surface to be treated, the control means commanding the rotation of part (21) around the parallel axis to the third direction (Y).

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A plant for drying painted surfaces with particular reference to vehicles and their stripped down parts and the various control procedures used.

This invention relates to the sector of plants used for drying. The invention was developed with particular attention, even though not exclusively, with vehicles in mind especially motor cars to be fully adaptable to the working needs of the body shop where the necessary procedures of drying the repaired parts and returning the vehicle body to its original state and as often as not also the stripped down parts of different shapes and sizes, doors, bonnets, boots etc take place.

In this sector of work it is noted that there are different plants, as the type mentioned above which normally represent the final stages of the repairing process of damaged vehicle in the body shop after these damaged parts have been straightened out , the putty has been used and varnishing has been done according to the traditional methods. The varnishing stages and the following drying steps in a body shop or at least a part of them represent two of the most delicate steps in the process of repairing a vehicle because with these the outside surface of the vehicle returns to as it was. A not perfect out come of the varnishing process could give place to an effect that is not quite the same as before and irreversibly with the consequence of the repair

work being seriously compromised and which must to the larger part be repeated giving way to higher costs and time to restore the vehicle to its original state. In particular the drying stage must favour a rapid evaporation of the solvent in the varnish used thus reducing to a minimum the time that the vehicle has to spend in the spraying booth. The booth is equipped in such a special way as to avoid dangers of pollution from the surface of the body work due to for example, the dust in the atmosphere. In fact one of the highest costs in the process of repairing the body work of a vehicle is the time in which it, or the various stripped down parts, spend in the spraying booth, waiting for the varnish to dry or at least sufficiently dry so that dust can not stick to it.

The problem mentioned above has become more acute recently and will always become more and more felt in the future, due to the progressive laws being enforced for varnishes or paints in which half the solvent is water thus slower to evaporate with respect to traditional solvents for paints which are highly volatile but at the same time also dangerous to the health and the environment.

This invention offers therefore a drying plant for the body work of a vehicle thus solving the above problems, providing a rapid drying of varnished surfaces particularly for the body work of vehicles and their stripped down parts also when

so called watered down paints are used. Another goal of this invention is to offer a control procedure for the drying process which gives maximum flexibility in its use and ensures a first class service for drying times, programming time and the managing of the drying process in the context of the repairing of the vehicle and its stripped down parts.

Another aim of the invention is to supply a process for the checking of a drying plat, that is meant to allow the maximum grade of flexibility and to allow the drying time optimisation with reference to both time programming and managing of drying process within the vehicles and their stripping down part reparation.

Another aim of the invention is to give a procedure to acquire data regarding the profile or shape of a vehicle which can be memorized in case of being needed in the future for a similar drying process of the said vehicle and its stripped down parts or for a similar vehicle

The above objective will be achieved by means of a drying plant for varnished surfaces and, in particular vehicles and their relevant stripped down parts, including the main framework, one mobile gear moving towards direction A, at least another gear (twinned with the first one) moving towards direction B and rotating around an axis parallel to a third direction C, heating tools connected to the first

mobile gears, a second group of heating tools (connected to the second mobile gears), controlling tools aimed to lead the movement of the gears in the directions of A and B in accordance with pre- determined parameters, sensory organs connected with the second mobile gear in order to determine the direction in respect to the surface being dealt with, controlling tools to drive the rotation of the second gear around the axis parallel to the third direction as indicated by the sensory organs .

The invention also takes into account a procedure to control the above mentioned plant understanding the phases to plan a series of parameters representing one or more portions of the surface which has to undergo a drying treatment and to activate a control system to command selectively the mobile parts of the plant and to activate the heating parts.

Another variation offered by this invention takes into account a plant for drying varnished surfaces, in particular vehicles or their respective stripped down parts, including a main framework, one mobile gear which moves in the direction A, at least another mobile gear in the direction B twinned with the first gear and turning around an axis parallel to a direction C, selectively heated tools which are twinned to the first mobile gear, another selectively heated tools which are twinned with the second mobile gear, means of control being positioned in order to selectively command the motion

of the mobile gears along directions A and B and rotating on direction C, respectively, means of command being associated to the control means in order to command the motion of the mobile gears along a determined way which is defined by a series of points. These points correspond to the positions of the second mobile gear with reference to direction A and B and to its angular rotation on direction C.

The invention also concerns a tracking procedure of points that refer to a body profile positioned on a defined space within the drying plant framework, above mentioned, and including a phase of tracking groups which command the body forward. The phase also includes the recording of significant signals for the interference of the tracking group sensors with a body, to guide the tracking group along an identified way form the border of interference of the sensors with the body, by acquiring and periodically memorising data of the tracking group position according to the coordinates along direction A and B.

An advantage of this invention is that it has the possibility of optimising a drying process which is able to define in a personalised way both the surface to which the heat will be transmitted and the timing exposure to the heat on the part of the vehicle body. For instance it is possible to programme different treatments for the different sides of the vehicle or to decide along which parts of the vehicle to start on or

to finish the mentioned drying process. The plant is also equipped for taking on a number of possibilities to transmit heat and in particular, this occurs through radiation lamps selectively activated to heat up and therefore to dry only the surfaces needed to be treated, therefore time is saved as well as energy, as only the lamps needed are activated.

The controlling system of the plant can be used also by non specialised operators, through the selection of pre-determined drying treatments giving a guaranteed result based on the kind of paint to be used with a substantial simplification of the selection procedure of timing, and of intensity of heat exposure of the surface to be dried.

Another advantage is the personalisation of the drying treatment, for instance programming permanently the treatment data, memorizing specific data, to call up on request the data, subdivided and organised according to the operator, the type of vanish or the type of treatment. The fact that it is possible to memorise the data of the specific treatment makes it possible to group a series of treatment cycles to be done one after the other by inserting the required data at the same time so that the operation will be automatically carried out. This will be particularly useful when, and this happen frequently, there is to dry in succession a vehicle and/or its stripped down part which normally hang or are leant or laid down in the drying area but separated from the vehicle.

Another advantage due to the flexibility of the plant is the possibility of programming the performance speed of the operation depending on the particular vanish to be used or/on the shape of the vehicle or its parts . Also the distance between the source of heat and the surface to be treated can be regulated with adequate margin in order to obtain the best drying results in the shortest possible time. This means better plant productivity, better job organisation with the repairing and painting of the vehicle, and high client satisfaction as clients demand their vehicles back in the shortest time possible.

The particular constructional characteristics of the plant and in particular its modularity is that it is easily adaptable to varied types and sizes of spry paint booths normally used in the field of spraying for cars, vans, lorries, buses. Above all, the modularity of the plant gives the possibility to install and to test it in a short time, thus reducing drastically the time that the spry booth is out of use and above all making it not necessary to have lifting devices.

Accordingly, a further characteristic is that the present invention has allow for a cross brace to which is movable in a vertical direction in such a way that it follows the profile of the vehicle thus allowing a first class drying process always on horizontal surfaces. Above all it is

possible to dry in a first class way vehicles of varies heights and eventual profile specification.

According to another characteristic of the invention, the cross brace is also revolving around an axis transverse in respect to the vehicle, in such a way as to orientate the heating group for drying the surfaces both at the front and at the back of the vehicle with an improvement in the result and in the time needed for a treatment in respect to those obtained by the traditional techniques.

Another characteristic consists of bars supporting heat emission group which are vertically movable, rotating round a vertical axis in order to obtain the best drying condition along the side of the vehicle. Another characteristic is that the supporting hanging bars are horizontally moveable ether together or independently. Another advantageous characteristic is that hanging bars are moveable transversally in distance and nearness together or independently, in order to achieve the best position for drying the vehicle or its stripped down parts which are awaiting for treatment after the vanishing process. Both characteristics of the mobility transversally, above all, allow an efficient system for the operation of drying surfaces of the vehicle in the case, as indicated above, of having to dry the frontal and/or the posterior part. In such a way as to avoid overlapping or excessive heat on the side

of the vehicle or its stripped down parts. This will be described in a better way later.

Another characteristic of the invention is a tracking device to detect data relating to he shape of the car and its stripped down parts. This is done through a guided movement both horizontally and vertically by the tracking device. This movement can be manual or automatic.

Further characteristics and benefits evince from the preferred description that follow, with reference to the attached figures, and in particular:

- Fig. 1 is a general perspective view of a plant which has been designed according to the present invention
- Fig. 2 is a schematic perspective view of a moving carriage of the plant parts of the fig. 1
- Fig. 3 is a transversal schematic section of a bar or a horizontal group of the plant shown in the fig. 1, that, in particular, shows the sensors groups disposition.
- Fig. 4 is a schematic view that shows the disposition of the radiant panel of this present invention in the operative configuration of starting up process of the vehicle
- Fig. 5 is a schematic representation of the positions that takes the bar or the horizontal group during the operation of treatment of the vehicle

- Fig. 6 is a schematic representation of the tracking group including the four photocells
- Fig. 7, 8 and 9 are schematic representation of the tracking group of the fig. 6 during three different tracking conditions
- Fig 10 is the schematic view of the bar or horizontal group check in the present invention according to the vehicle profile or its stripped down part characteristics

With reference to fig. 1 a drying plant for varnished surfaces is made up of a supporting structure 10 composed of a series of vertical columns 11 which stand on a preferably regularized base 12. The vertical columns 11 are connected by longitudinal beams 13 and traversal ones 14 which in a complexity make a framework 15 preferably square. The total dimension of the support structure 10 shows substantially the maximum space occupied by the drying plant which can be adapted to varies type pf spraying booths simply by altering the length of the beams of the framework 15 and in particular but not always, varying the longitudinal beams 13. In preference also the columns 11 and the beams 13, 14 are made with metal shapes of the same type generally square, having on the side longitudinal grooves 16. In describing the plant and clarifying the way it functions a reference will be made to a group of axis X, Y, Z, placed as seen in fig. 1

according to the direction of the longitudinal beams 13 of the transversal one 14 and the vertical column 11.

On the longitudinal beams 13 there are two longitudinal carriages 17 on which are fixed the ending parts of a main crossbar 18 and two hanging vertical uprights 19, also they are made, as the carrying main crossbar 18, with the same section adaptable for the supports 11 and the beam 13. Two vertical carriages 20 are mounted sliding parts on the vertical uprights 19 in a position facing each other, to sustain the crossbar 21 which serves to support the heating groups or radiant panels 22, is the emission of infra-red rays fed by the method generally uses in the sector by gar or electric energy. The support crossbar 21 is mounted revolving according to its longitudinal beam, parallel to the axis Y, according to a certain way and will be cleared later on this report.

Another two sliding transversal carriages 23 are mounted on the main crossbar 18 and respectively support two hanging arms 24 which are the supports for the heating groups and the lateral lamps/panels 25. In a variant of the plant the hanging arms 24 can be mounted swinging with respect to the main vertical beams, parallel to the general beam Z. Preferably the hanging arms 24 have an angular configuration, with an inferior portion substantially vertical 24a and a portion above 24b slightly inclined towards the internal of

the framework. This configuration allows a more uniform distribution of the heat in the case of a treatment of cars, as its length corresponding to its roof is generally less than the width in correspondence to the body of the car. Naturally the shape and the inclination of the hanging arms 24 can be different to those illustrated according to the use the plant will have.

The action of the longitudinal 17, vertical 20 and traversal carriages 23 works preferably, even if not exclusively, by a system of motorised belts and pulleys, in particular using electric motors, even though it is possible to change the plant where an alternative system can be used however having a similar function, for example a chain system, an endless screw, direct traction with motors mounted directly on the carriages and other systems in general. In more details, the longitudinal carriages 17 are put into action at the same time by a common motor 26a fixed to one of the transverse beams 14 and preferably connected by a group reducer 27 and a transversal driving belt 28 on which are connected driving pulleys (not shown in fig. 1) placed near the longitudinal beams 13. Similarly another command motor 26b is fixed to the extension 29 protruding out of carrying crossbar 18 and twinned to a driving belt 30 whose ends command the two action pulleys for the vertical carriages 20. Two further motors 26c, 26d are also mounted on the carrying crossbar 18,

close to the two ends and commanding each of the transversal carriage 23.

With specific reference to the preferred solution illustrated in fig. 2, each carriage (longitudinal 17, vertical 20 or traversal 23) includes a basic structure with at least a panel 31; this panel is facing the generic shape 32 which was used for the carrying structure of the plant. On the surface of the panel 31 facing the shape 32, driving devices are mounted, for example guides 33, which run inside the grooves 16 and work as roller bearings. Obviously, the above solution, is only the privileged example but does not preclude the possibility of other different solutions about the setting up of the carriage or the guides and the bearings in accordance with the generally known methods in the sector of mechanical constructions.

Two revolving pulleys 34, 35 are mounted on the two extremities of the generic structural shape 32, one driven and one driving (this latter twinned with the generic motor 26); a belt 36, preferably of a tooth type, is wrapped around them. The belt 36 is closed with a ring with the two extremities 36a and 36b fixed on the shape 32 of the carriage in such a way that part of it runs inside the shape 32. This will enable a good functioning of the plant and will guarantee energy saving during production as well as a good precision and a good moving of the carriages.

The rotation system of the crossbar 21 around its longitudinal axis, that it is essentially parallel to the axis Y of the fig. 1, takes place in a preferred way through a motor 26e e which is directly assembled on one of the vertical carriages 20 and it is twinned with the crossbar 21 through a generic gear transmission. How it has been shown in the fig. 3, the crossbar 21 includes a covering 37 which is fixed to a shaft 38 that swings around an axis essentially parallel to the axis Y of the fig. 1. In the frontal part 21a of the crossbar 21, in which are positioned the radiant panels 22, there are also sensor means those functioning will be treated later. In particular, we expect to have two sensor groups 39, preferably ultrasound ones, which are opposite to the radiant panels 22. One or more security sensors 40, of the photocell directional type, are also installed in correspondence to the frontal part 21 of the crossbar 21. These sensors are preferably oriented in a motion that record the presence of an obstacle and a pre-determined distance along the indicated direction form the line 41 of the fig.3, which is preferably oriented of about 45° with respect to the radiant panels 22.

The electrical or the gas supplies which are destined to feed the plant radiant panels, as well as the motor electrical supply, run along le fixed and mobile plant structures in order to reach both the radiant panels and the starting up motors. Therefore the plant is expected to have general

parts, such as flexible cable container 42 in order to allocate the supply lines.

In the fig. 4 it is exemplified single radiant panel disposition that compose the complex of the heating of the transversal 22 and vertical 25 radiant groups in the condition that anticipate a general vehicle V treatment or its stripped parts. Each radiant panel 22',25',25'' of each heating group is possible to be activate independently to the others. This independent functioning guarantees a great deal of flexibility in the treatment of the vehicle V. At the same time this functioning ensures energy savings in case only single parts of the vehicle V have to be dried the non relevant panels can be kept off. The entire functioning of the plant, including the starting up of the single radiant panels and their progressive movement, is commanded trough an electronic control system, whose working process will be specified later.

While the drying process occurs the gradual movement of the radiant panel group which is the consequence of the moving of the main crossbar 18, along the direction of forwarding Y. Along the basis of the main framework 10 there is preferably a graduated scale that allows to set the fundamental treatment parameters. In particular it is possible to determine, even approximately, the starting point of the area to be dried. This determination procedure indicates the

distance from the origins of the scale along the axis Y. In this way it is possible to limit the treatment exclusively to the posterior doors of the vehicle, or exclusively to the right anterior mudguard, and so on.

A similar graduated scale can be positioned even towards the axis X, in order to regulate the distance of the vertical hanging arms 24, and of the panels 25' and/or 25'', with reference to the areas to be treated. This procedure distinguishes this plant from the other similar ones. In fact with this plant there is not need to make sure the vehicle V is positioned exactly in the middle of the plant. In addition it is possible to set a series of treatments, even complex ones, which can dry different areas from the right and the left sides of the vehicle V. This occurs by programming the distancing of the heating groups from the lateral parts of the vehicle in the areas which are not necessary symmetrical, in which there is not need for drying process.

As was shown before, the crossbar 21, and consequently also the heated radiant panels 22', follow the movement along the axis X, it can selectively lift up and down along the axis Z and rotate on an axis parallel to the axis Y. This process is shown, in the fig. 5, that highlights how during a complete process of drying of the vehicle V , the generic heated radiant panel 22' is taking, in a different sequence of time, a different range of positions. In particular,

commencing from a starting up position where the heated radiant panel 22' is on a position t1, this is the given position that allows the drying of the front part of the vehicle V; the control system drives the movements of the crossbar 21 in order to induce during the following steps of time t2.....t12, the heated panel to the drying of the bonnet, the roof and the back part of the vehicle V. The most correct process of the generic panel 22' in accordance to the surface to be drying, basically is kept in a parallel position from the surface of the vehicle, is guaranteed thanks to the sensors 39 that record the distance of the two boards of the radiant panel 22' from the surface of the vehicle and send signals to the control system, which are rotating on the crossbar 21, can keep it constant. In case the sensors 39 should - for any reasons - loose the signals, the security sensors 40 guarantee, in any case, that the crossbar 21 or one of its borders, never comes to close to the surface of the vehicle V, ensuring the stopping of the forwarding process of the crossbar 21 up to the re-establishing of the sensors 39 signals, or until an operator is cautioned from the visual and acoustic signals or similar, and comes to intervene.

Since the moment in which the drying process of the front surface of the vehicle V causes the movement of the crossbar 21 and of the generic radiant panel 22' along the vertical direction Z, in absence of longitudinal movements of the axis

X, the crossbar 21 is positively positioned in front of the lateral hanging arms 24 and to the each radiant panels 25', 25'', in a way that makes it possible to reach firstly the front surface of the vehicle V. In this way, in case the lateral panels 25', 25'' were on for the drying process of the lateral parts of the vehicle V in the front area, in any case, they would be positioned on a sufficient distance from the surface of the vehicle V and thus avoiding an overlapping of the heating of the lateral parts of the vehicle V during the period of time in which the axis X is in a forward motion. In any case, the possibility of overheating of the lateral parts of the vehicle V, that could emerge during the drying process of the back part, can be avoided thanks to the fact that the radiant panels can both be selectively turned off, and gradually kept to a distance from the lateral parts of the vehicle V along the traversal direction Y.

The possibility of a traversal movement of the arms 24 and of the radiant panels 25', 25'' is very helpful, as often occurs, whenever single parts are positioned behind the vehicle V for an autonomous painting and drying process before assembling on the vehicle. We refer, for example to the stripped down vehicle V doors, often hanged vertically, in correspondence to which the vertical arms 24 are kept close to one another leaning to the centre of the plant framework until reaching the best drying distance. The movements and orientation abilities of the crossbar 21 and of

the radiant panels 22', on the other hand, allow the treatment in a first class way of also the single parts whenever they are positioned in a laying down position, as often occurs, for example in the painting of single bonnets.

During the operative functioning of the plant, for a operative phase of setting and selection of the drying process to apply, including the setting of the coordinates along the direction X and Y of the surface to be treated, and the setting of the lamps or specific radiant panels that are to be activated, follows an operative phase of turning on the selected heating groups, that in such cases include gas lamps and can cause the turning on of the resistances for the pre-heating of the lamps and the following supply of gas in accordance to a pre set timing data base. The definition parameters of the drying process can also include information related to the speed of forwarding processes for the time unit, to the distance of keeping of the panels or radiant lamps according to the surface to dry, and - in some cases, the most specific functioning parameters, such as the supply of gas pressure for the alimentation of infrared lamps. An example of a process with some established parameters is the one that occurs whenever there is a single choice of the type of paint or painting to be dried, independently of the fact that it is a preliminary basic treatment or a definitive one. However, it is possible to personalise the control system programme and realise the possibility for the user to have at

his disposal a few pre-established choices, which are inserted previously, for example on a memory support according to the kind of the specific activity carried out in the specific centre of painting where the plant in question, is to be installed.

At the end of the parameters settings, or choice of the pre-established parameters, the control system, and in particular the interface-user of the specific programme, may ask to the operator whether to programme other treatments to be carried on eventually in sequence one after the other. In accordance to the type of treatment selected by the user, the control system will provide the best choice in order to optimise the time and procedures of treatment, for example by keeping the lamps turned on in between one treatment and the other in which a series of drying treatments have been programmed.

In the beginning phase of treatment, the logic behind the control system allows the checking of the necessity of movements of the three main motorised groups of the plan: the carrying crossbar 18, the arms or vertical groups 24, and the crossbar or horizontal group 21. After reaching the determined starting up position, the system provides for the progressive lifting down of the horizontal group 21 until taking it to the determined distance of treatment fro the surface to be dried, determined by the sensors 39. In case the starting treatment point was established in an area in

front of the vehicle V, for example due to the fact that there is the need of drying the front part of the vehicle, the horizontal group reaches the end and thus rotates 90°, basically facing in front of the vertical part to be treated. From this position, the horizontal group, rotated at 90°, is driven forward rapidly to the point in which the sensors 39 recognize the optimal distance of treatment of the frontal part of the vehicle. At this point the treatment of the frontal part of the vehicle V begins, with the progressive lifting up of the horizontal group and its progressive swinging in order to adapt to the contours of the vehicle.

The vertical groups, supported by the same carrying crossbar 18 that also supports the horizontal group, moves forward kept in the stand by position, preferably in the position of external end running. Once the established starting point is reached the control system commands that the lateral groups move close to the lateral parts of the vehicle V or the single part to be treated. As already said previously, the functioning, the activation and the movements of each lateral group is independent from the other vertical group.

At the end of the treatment, all groups return to their original resting position (at the end of running for the vertical group, at the end of top running for the horizontal group) and the carrying crossbar 18 returns rapidly back to

the starting position and thus becomes ready for a new treatment process.

The control system is provided with threshold parameters to determine the functioning of the plant and in particular, the eventually need to keep a distance between the vertical groups and the lateral part of the vehicle V towards the external end of running position. This occurs whenever the need of the horizontal group, to treat the frontal or back part, essentially vertical, of the vehicle V or its other stripped parts, slows down or stops the longitudinal forwarding of the groups along the axis X.

In a variant version of the plant, above described and of its control process, there are not the sensors 39 on the crossbar 21 and eventually the security sensors 40 too. In such case, an electronic control system guides the plant according to the identification elements of the vehicle surface V and/or its parts, in case also the latter are to be dried. The surface identification elements, that preferably include a series of points of coordination (x, z) are generally memorised in the electronic controlling system, that in particular may include an electronic elaborator provided with data memory. Such coordination is the result of a preliminary procedure of tracking, that takes place during the installation of the plant, as it will be described later in full details. Alternatively, the points of coordination may

be installed preliminary from an external data base, for example one provided from the various vehicles or paint producers. It will be described in details the preliminary process of tracking that takes place during the installation of the drying plant of this invention. This invention, in a preferred version, yet not limited to this version, includes a tracking device assembled in a mobile way, at least according to the longitudinal X and vertical Z direction.

More in details, the fig. 6 is a frontal schematic view of a tracking 45 group that includes sensors 46, preferably four photocells which are assembled in a square disposition and that interact with a correspondent emission group. In particular this group includes four lighting sources and it is positioned facing the tracking device alongside a direction that is maintained constantly parallel to the dissection of the axis X. The tracking device 45 and the correspondent emission group may be fixed each one to the vertical carriages 20 which are positioned on the two uprights 19, or to their appendix. In a preferred way, the tracking device 45 and the correspondent emission group are fixed to the respective slides (not showed in the figures) which are installed in a mobile way on the uprights 19, yet separated and independent to the vertical carriages 20 that support the crossbar 21.

In case there are four photocells in use, the disposition of the sensor 46 and of the correspondent emissions, which are aligned in the direction X, make it possible for four bundles of straight parallel lights generated from the lightening sources to hit the four correspondent photocells 46 lightning them up. This process takes place, in case the space between the two uprights 19 and, in any case between the tracking group and the emission is clear. A generic body, for example a vehicle V or one of its stripped down part, placed in the plant of this invention, as showed in the fig. 1 and 4, can interrupt one or more bundle of light, depending on the position taken by the tracking groups and emission along the longitudinal X and vertical Z axis.

In the present variant of the drying plant, the electronic control system of the plant is able to command the synchronized movement of the tracking group 45 and of the correspondent emission group along the transversal directions X and Z. To record the profile or the shape of the vehicle V and/or its stripped down part, the tracking group 45 and its correspondent emission group move close to a starting point to be recorded, in order to move close, for example, to the frontal part of the vehicle V. At one certain point the profile of the vehicle will stop the mentioned bundles of lights in correspondence of at least one of the four photocells. In the particular example of the fig. 7, it is

showed the interference on the part of the vehicle V with the two photocells positioned at the far right.

The control system of the plant is programmed in order to record a signal of interruption on the part of at least one of the four photocells 46 an to memorize one point of the profile with coordinate (x, z) defined from the position taken by the tracking group 45 in that particular moment with reference to the direction X, Z. The control system is also programmed to guide the tracking group 45 with a combined movement according to the direction X, Z. This occurs in such a way that at least one photocell, and preferable two, keep darkened on the behalf of the shape of the vehicle, while at least another photocell, and preferable two, keep both contemporaneously lit. The fig. 8 and 9 refer, as an example, to the position taken by the tracking group 45 according to the vehicle profile V or one of its stripped down part. This with reference of particular case of recording of an horizontal profile line, as it could be, for example the roof of the vehicle V, and of a pendent profile line, as it could be, for example the bonnet or the windscreen of the vehicle V.

At the end of the tracking process, on the electronic elaborator there will be memorised a series of couple of points (x, z) that as a whole, with a predetermined resolution, define with a certain grade of precision, the

profile of the vehicle V and/or its parts. The points of the profile (x, z) which are memorised, can be conveniently used to guide the next running process and the orientation of the crossbar 21. This procedure takes place during the drying process, avoiding the use of the sensors 39, above described. In particular, the crossbar 21 can be guided along the desired run, thanks to the commands of position that establish the next positions (x'', z'') along the direction X, Z which it is conduced the axle of the rotation of the crossbar 21. In addition, these commands establish the angle of rotation θ around the axis Y of the same crossbar, and thus of the radiation lamps assembled on it. These are assembled in a way so that the lamps are kept as much as possible parallel from the surface of the vehicle V, to a pre-determined distance from the vehicle, in order to avoid that any portion of the crossbar 21 interferes with the vehicle itself.

In order to determine the list of movement and orientation coordination (x'', z'', θ) of the crossbar 21, a particularly efficient, even if not limitative for the functioning of this invention, consists in one first elaboration of an group of points or couple of coordinates (x', z'), which are theoretical and calculated by starting from the points of the profile (x, z) which define the theoretical profile of the vehicle V. In particular, the theoretical points (x',z') are positioned in a pre-determined distance from the points (x,

z) along the direction perpendicular to the mentioned theoretical profile. The crossbar 21 is ideally divided in an anterior portion B and a posterior one A (see fig. 10) with reference to its axis of rotation, and an appropriate algorithm of points selection (x', z') calculates the sequence of the list of values (x'', z'', θ) such way enable avoidance of interferences of the crossbar 21 portion A and B with the vehicle V profile during the next drying process.

To sum up, the structure of the plant of this invention, as the operative functions commanded from the control system, preferably including an electronic programmable elaborator, result to be able to avoid the inconveniences of the technical note. This is possible thanks to an efficient and economic solution to all the problematic issues related to the drying of painted surfaces. And, in particular, with reference to the vehicle application, especially, even if not exclusively, when painting products in which the solvent is made up of water or with a percentage of water is used.

Obviously, keeping the principle base, the forms of application and the particulars of realisation may, even largely, change according to what has been described and illustrated with reference to the preferred example showed in the figures, without, for such reason, overcoming the present invention.

CLAIMS

1. The plant for the drying of painted surfaces, in particular vehicles and their detached parts, characterised by the fact that the plant include a main framework, a fist mobile part which is the main crossbar (18) according to a first direction (X), at least one second part which is the crossbar (21) twinned with the mobile crossbar (18) according to, at least one second direction (Z) and able to rotate on a parallel axis to a third direction (Y), first selectively pre-heated panels (25) being twinned to the first mobile crossbar (18), second selectively pre-heated radiant panels (22) being twinned to the second mobile part (21), means of control, being placed in order to selectively command the movements of the moving parts (18, 21) along the first and the second direction (X, Z), depending on pre-determined operative parameters, sensors (39, 40) being associated to the second mobile part (21) to determine the relative orientation according to the surface to be treated, the means of control commanding the rotation of the second part (21) around the above mentioned parallel axis to the third direction (Y) depending on the signals of the sensors (39,40).

2. The plant according to claim 1, characterised by the fact that, in its use, a vehicle or at least one

of its stripped down part are positioned within the internal area of the structure framework, pre-determined portions of the vehicle surface or at least one of its stripped down part, being identified by the above mentioned operative parameters and subjected to drying process through the selective activation of the heated means which are brought by the mobile parts (18, 21) close to the above mentioned pre-determined portions.

3. The plant according to claim 1, characterised by the fact that the first selectively heated parts (24) are assembled on third parts (24) twinned with the first mobile main crossbar (18) and themselves too being selectively mobile along the above mentioned third direction (Y).

4. The controlling process of the plant with reference to the claim 1, characterised by the fact that it includes the phases of setting of a series of representative parameters of one or more surface portion to undergo the drying process and to activate the control system to command selectively the plant mobile parts and the activation of the heating means.

5. The plant for the drying of painted surfaces, in particular vehicles and their detached parts, characterised by the fact that it includes a main

structure framework, a first mobile crossbar (18) according to a first direction (X), at least a second group (21) twinned with the first part (18), mobile according to at least one second direction (Z) and able to rotate on a parallel axle to a third direction (Y), first selectively heated panels (25) being twinned with the first mobile part (18), second selectively heated radiant panels (22) being twinned with the second mobile part (21), control means being positioned to selectively command the movement of the mobile parts (18, 21) along the first and the second direction (X, Z) and rotating on the third direction (Y), means of command being associated to the control means to command the movement of the mobile parts along a pre-determined run, defined by a series of points (x'', y'', θ) correspondent to the second mobile part position according to the first and second direction (X, Z) and to its angular orientation around the third direction (Y).

6. The plant according to claim 5, characterised by the fact that it includes at least one tracking group (45) with sensors (46) selectively assembled in a mobile way with reference to the first and second direction (X, Z) to acquire a plurality of points (x, y) of a body profile (V), positioned within the space defined by the main framework, according to directions essentially parallel to the third direction (Y).

7. The plant according to claim 6, characterised by the fact that at least one tracking group (45) includes four sensors (46) of the photoelectric type.

8. The tracking process of the points of a profile body (V) positioned within the space defined by the plant framework according to claim 6, characterised by the fact that includes the phase of the tracking group command while forwarding towards the body (V), to record significant signals of the sensors interference (46) of the tracking group (45) with the body (V), to guide the tracking group along the identified run from the border of the sensor interference (46) with the body (V) acquiring and periodically memorising position dates (x, z) of the tracking group according to coordinates along the first and second direction (X,Z).

9. The process, according the claim 8, characterised by the fact that the means of command include means of electronic elaborator which are elaborated in order to transform the position dates (x, y) which are representative of the body profile (V) by position and orientation dates (x'', z'', θ'') of at least the second mobile part (21).

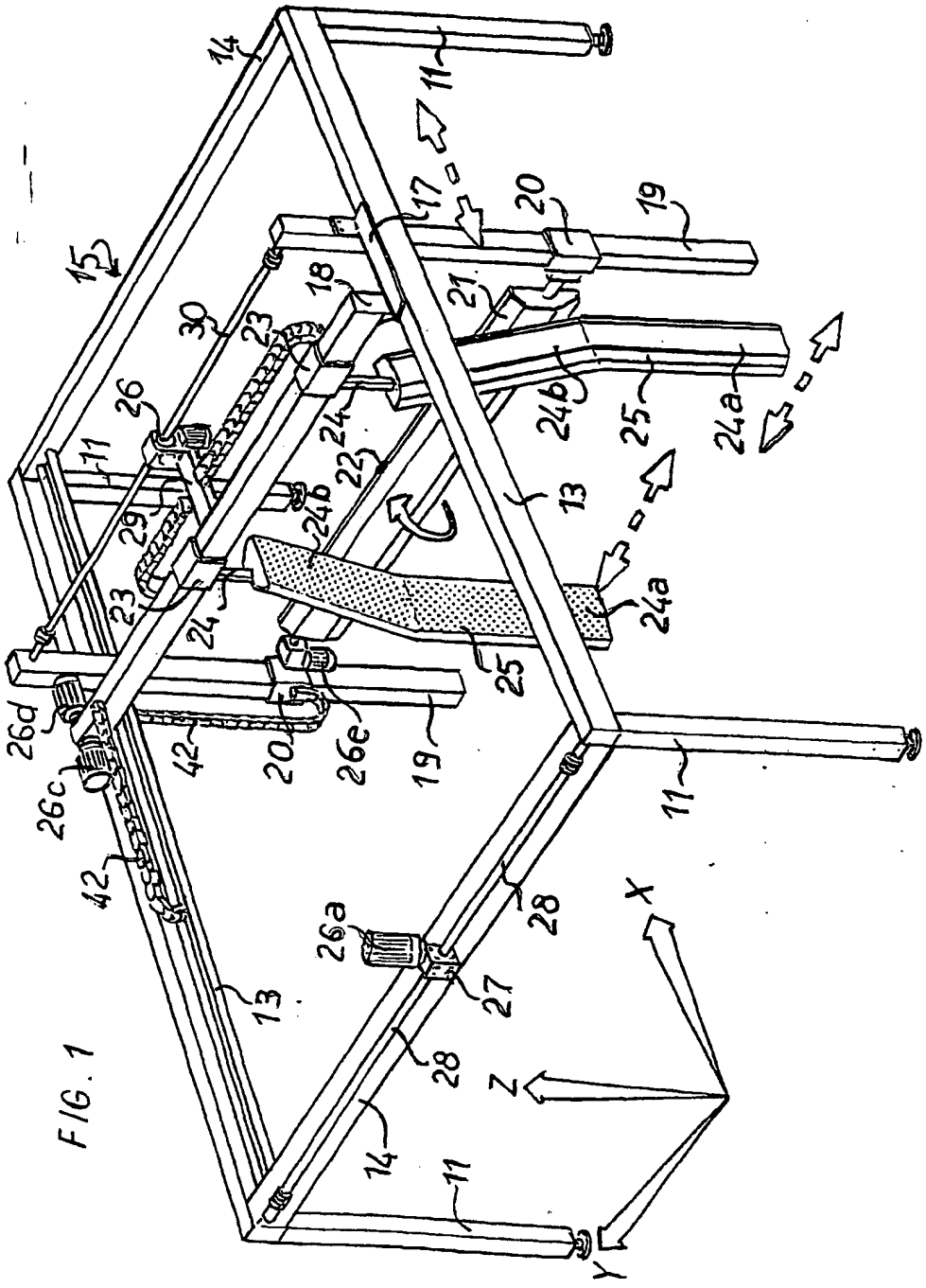


FIG. 1

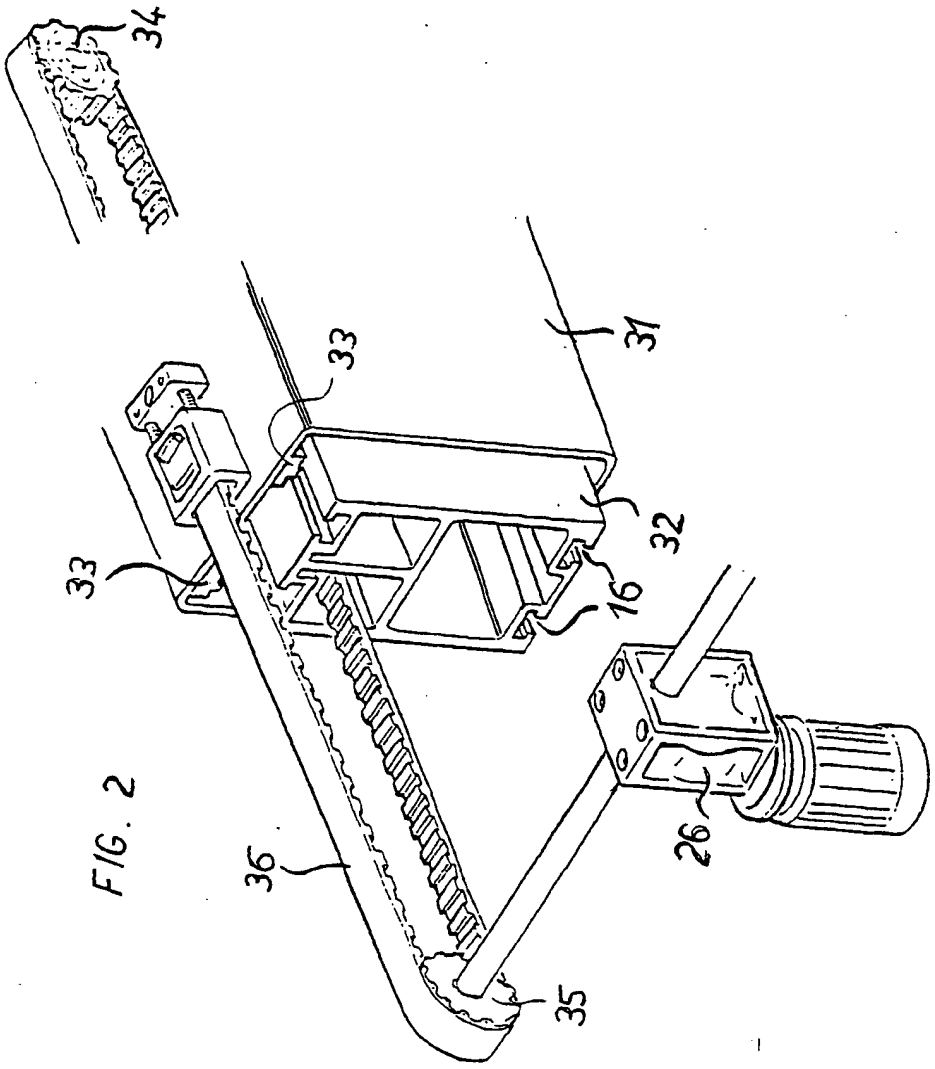


FIG. 2

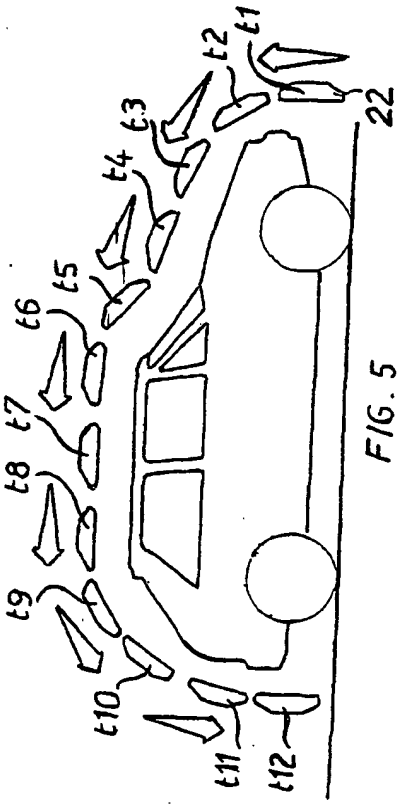


FIG. 5

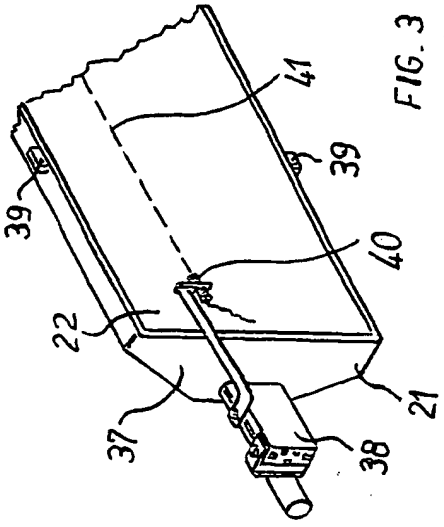


FIG. 3

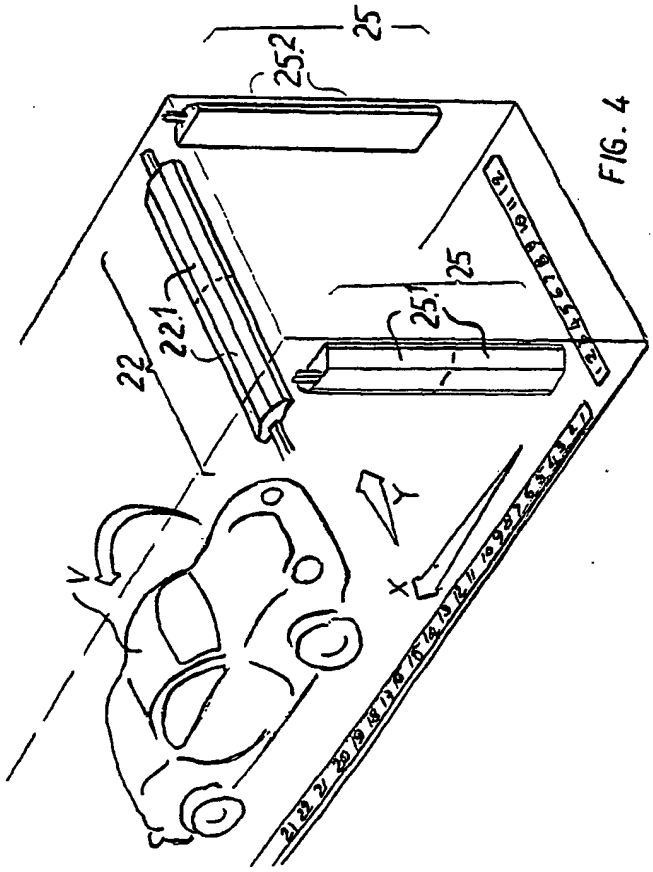


FIG. 4

FIG. 6

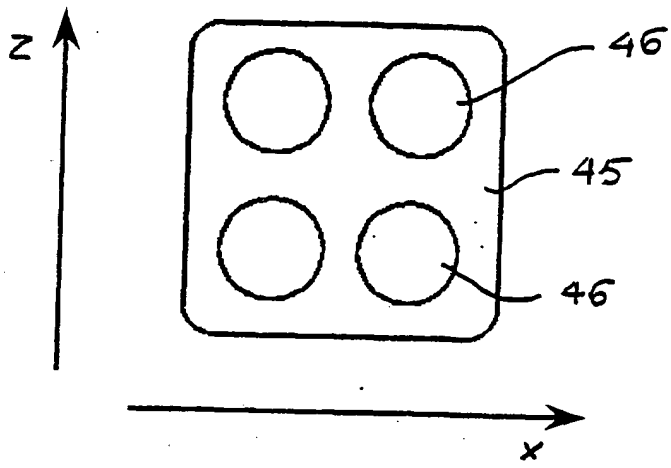


FIG. 7

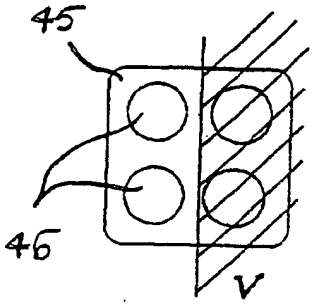


FIG. 8

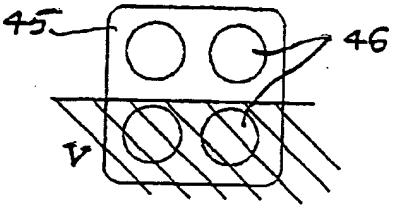


FIG. 9

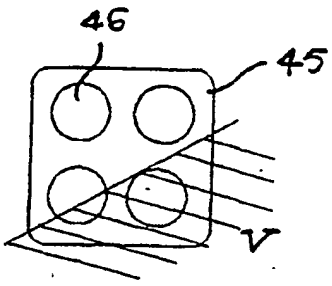
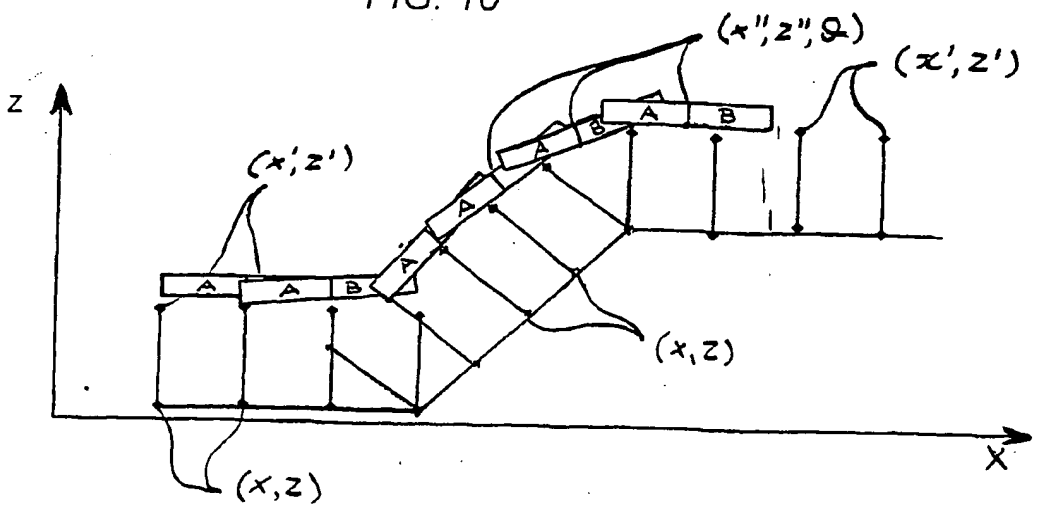


FIG. 10



INTERNATIONAL SEARCH REPORT

ional Application No
PCT/IB 02/01801

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F26B3/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F26B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	EP 0 851 193 A (PENTARA COMMERCIAL ENTERPRISES) 1 July 1998 (1998-07-01) the whole document	1,3,5,6 2,4 8,9
Y A	DE 298 11 072 U (BURKAMP MARTIN) 27 August 1998 (1998-08-27) the whole document	2,4 1,3
A	US 2 841 684 A (MISKELLA WILLIAM J) 1 July 1958 (1958-07-01) the whole document	1,3-5

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 August 2002	08/08/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Silvis, H

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Information on patent family members

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PCT/IB 02/01801

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